Proposed Changes to *Receiver Device Physical Testing* Section in SAS 2 Draft Specification

Mike Jenkins

11 March 2008

Changes from T10/80-146r0 based on discussion at SAS Phy face-to-face are in BLUE (and underlined for the sake of anyone with a black & white printer or monitor)

Table 72 in Section 5.3.7.4.4.1

Figure 131 shows the block diagram of the stressed receiver sensitivity test.
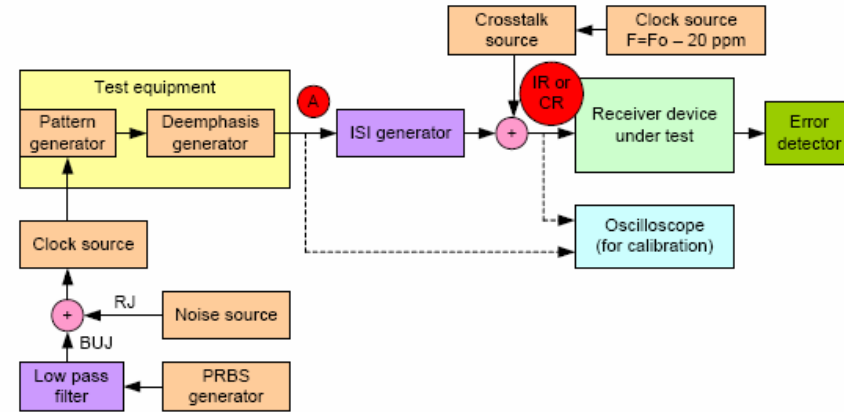

Figure 131 — Stressed receiver sensitivity test block diagram

The receiver device under test demonstrates its ability to compensate for channel intersymbol interference (ISI) representative of the SAS-2 reference channel while subjected to the budgeted jitter and cross talk sources.

Table 72 defines the characteristics of the signal at point A in figure 131.

Table 72 — Stressed receiver sensitivity test characteristics

| Characteristic	Units	Minimum	Typical	Maximum	Reference
Tx data pattern		CJTPAT			Annex A
Tx peak to peak voltage	mV(P-P)			800	5.3.6.5.1
Tx minimum rise/fall time	UI	0.24 (41.$\overline{6}$ ps)			5.3.6.5.1
Transmitter equalization	dB			2	5.3.6.5.5
Tx RJ	UI	0.15 (25 ps)			5.3.6.5.1
Tx bounded uncorrelated jitter	UI	0.000 22 (0.036 ps)			
Link dispersion penalty [a] [b]	dB	13			5.3.7.4.4.8
D24.3 delivered eye opening (Z1) [b]	mV	75		95	5.3.5.4
D24.3 delivered eye opening (X1) [b]	UI	0.15			5.3.5.4
NEXT offset frequency [b]	ppm	20			
Total crosstalk amplitude [b] [c]	mV$_{rms}$	4			

[a] Link dispersion penalty is the WDP of the delivered signal computed with Palloc = 15.4 dB.
[b] This specification pertains to the delivered signal at IR or CR during the receiver device compliance test. All adjacent phys in the receiver device shall be active with representative traffic with their maximum amplitude and maximum frequency of operation. Additional pseudo-random crosstalk shall be added, if needed, to meet the total crosstalk amplitude specification.
[c] Observed with a histogram of at least 1 000 hits.

Tx Bounded Uncorrelated Jitter

- Value in draft is impossibly small
  - 0.00022 UI is possibly the result of unintentional Excel percent formatting

- Value in 8G Fibre Channel is 0.035 UI (~20% of TX DJ budget)

- Propose **0.10** UI for 6G SAS
  - Accommodates Tx BUJ plus SSC residue

T10/08-146r1

D24.3 Delivered Eye Opening (Z1)

- More repeatable to measure to center of trace
  - Use vertical histogram

- For 800mVpp, 2dB launch, simulation yields Z1 = 101mV
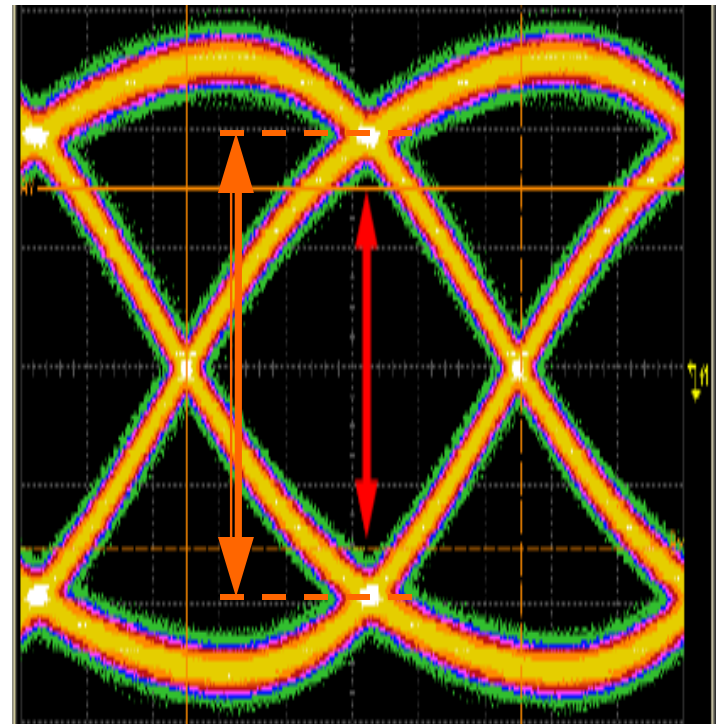
Consistency of
Ref Tx -> Ref Channel -> Ref Rx

Amp (mVpp)	Deemph (dB)	DFE taps	BUJ (DJ) (UI)	pattern	Vert Rx eye (mVpp)	Horiz Rx eye (UI)
800	2	3	0.15	random	22	0.18
800	2	5	.015	8B10B	100	0.42
800	2	3	0.14	random	24	0.19
800	2	3	0.0	random	34	0.32
800	2	3	0.0	8B10B	80	0.49
800	2	4	0.0	8B10B	98	0.54
850	2	4	0.15	8B10B	98	0.40
850	2	4	0.022	8B10B	108	0.53
850	2	3	0.022	8B10B	88	0.48
850	**2**	**3**	**0.10**	**8B10B**	**84**	**0.40**

Note: RJ = 0.15UI/14 in all cases

Recommendations

- Change Ref Tx (Table 65) & Tx peak-to-peak voltage (Table 72) to 850 mVpp
- Change Tx bounded uncorrelated jitter (Table 72) to **0.10** UI
- Change D24.3 delivered eye opening (Z1) (Table 72) to 100mV (min) & 115mV (max)
  - Measured at center of trace
  - Simulated value is 107mV for 850mVpp launch with 2 dB de-emphasis

Softer Recommendations…

- Change *DJ* in Table 65 to *BUJ* with a value of **0.10** UI

- Change value for "*Minimum eye opening (i.e., 2 x Z1 in figure 119)*" in Table 61 from 100mVpp to **84** mVpp

- Change value of Transmitter equalization in Table 72 from 2dB (max) to 2dB (nom) with appropriate max and min values

…and absolutely…

- Let's do this budgeting *earlier* in the development of the SAS 3 Phy specs